Advanced Energy Design Guide Webcast

Advanced Energy Design Guide for Small Office Buildings

by Michael Lane, LC

lightingdesignlab.com

BETTERBRICKS

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- **Lead lighting specialist at the Lighting Design Lab and has been with the Lab since its inception in 1989.**
- **Received Bachelor of Architecture from Washington State University in 1982, and has specialized in the lighting field for over 22 years.**
- **Is a member of the IESNA and was in the first class to be Lighting Certified (LC) by NCQLP.**
- **Serves on the IESNA Educational Materials, Sustainable Lighting & Energy Management Committees, the ASHRAE 90.1 Energy Committee and the LEED Sustainable Sites Committee.**

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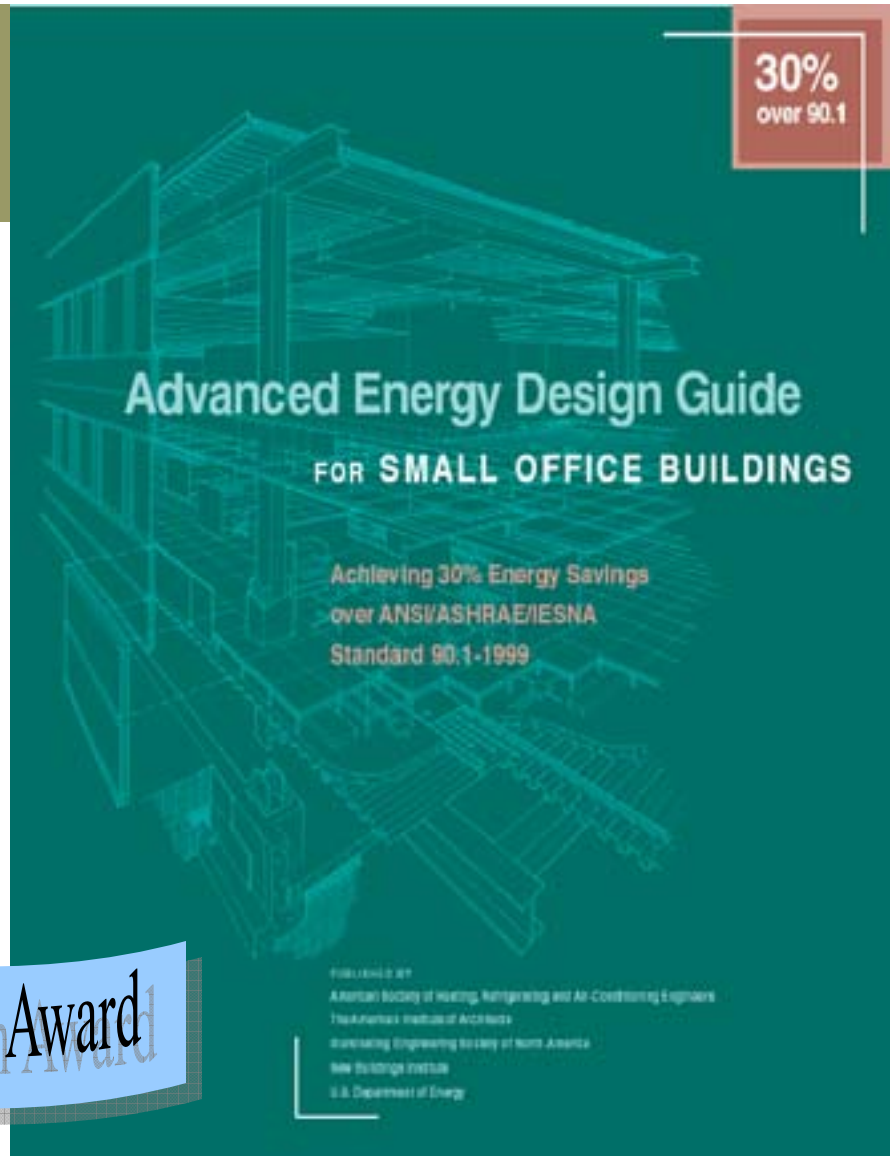
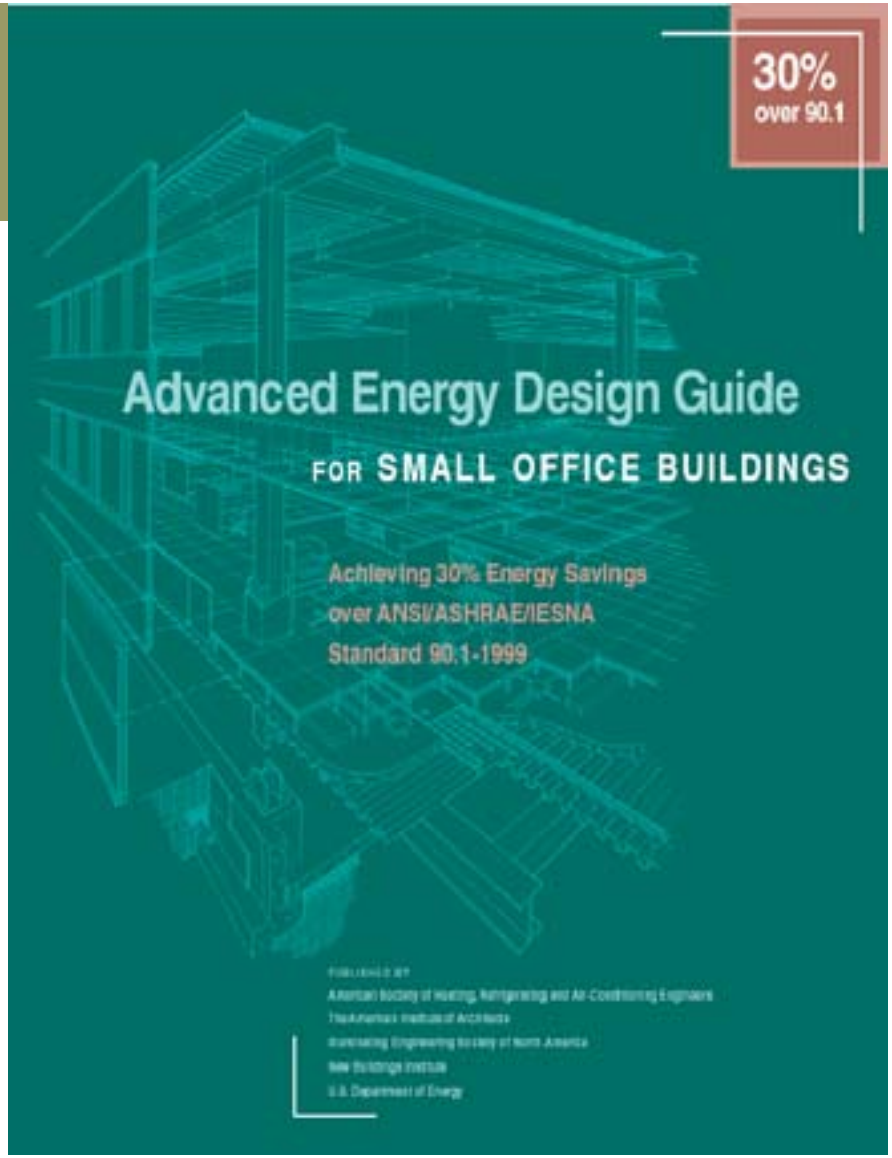
- **The "Guide" is intended to provide a simple and easy approach for use by contractors and designers who design and construct office buildings up to 20,000 ft^2.**



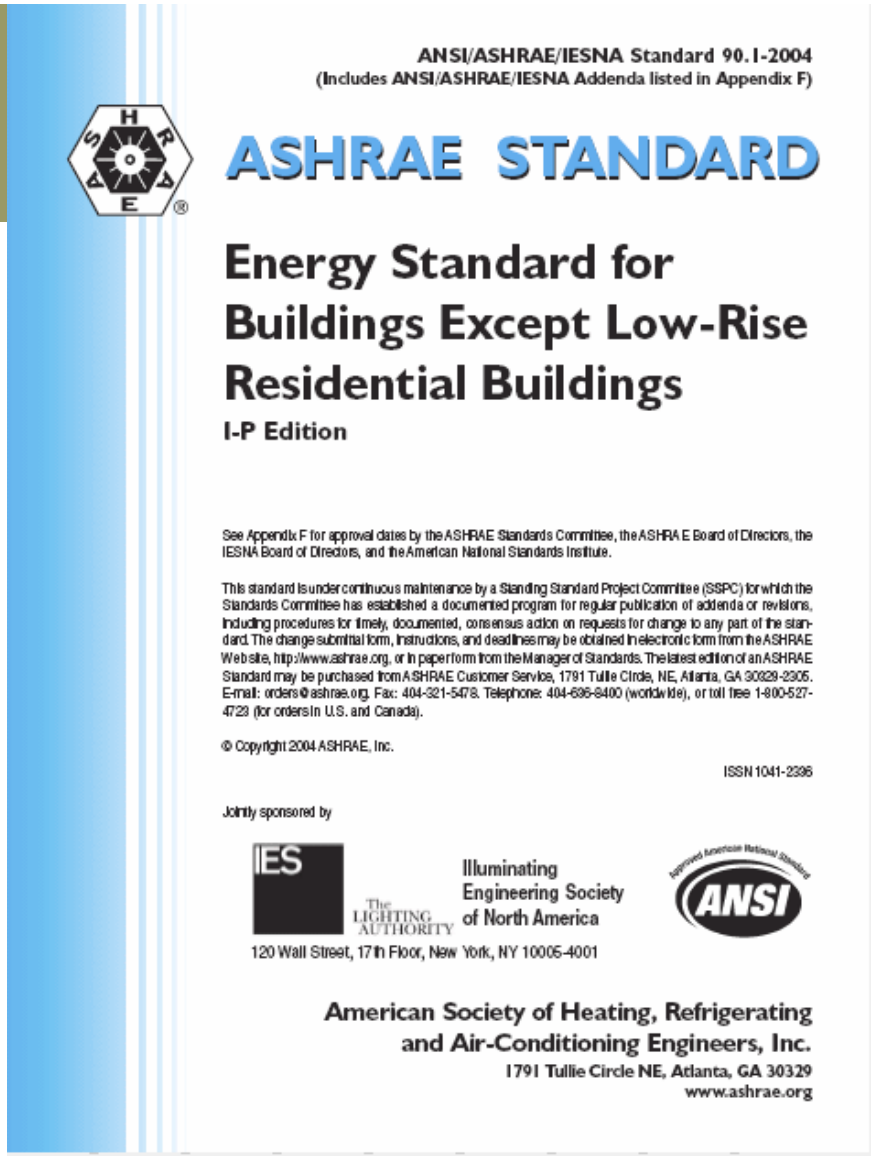
USGBC 2005 Leadership Research Award

- **Application of the recommendations in the Guide should result in small office buildings with 30% energy savings when compared to those same office buildings designed to the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1-1999.**



Why the '99 version?

- **DOE Determination:**
  - *DOE has issued a determination that the ASHRAE/IESNA Standard 90.1-1999 will save energy in commercial buildings. This process was completed and signed on July 15, 2002.*
- **State Certification**
  - *Certifications or Requests for Extension of Deadlines, with regard to Standard 90.1-1999, are due at DOE on or before July 15, 2004.*



ANSI/ASHRAE/IESNA Standard 90.1-2004
(Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F)

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

I-P Edition

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in U.S. and Canada).

ISSN 1041-2336

Jointly sponsored by

IES The LIGHTING AUTHORITY Illuminating Engineering Society of North America

120 Wall Street, 17th Floor, New York, NY 10005-4001

ANSI

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
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www.ashrae.org

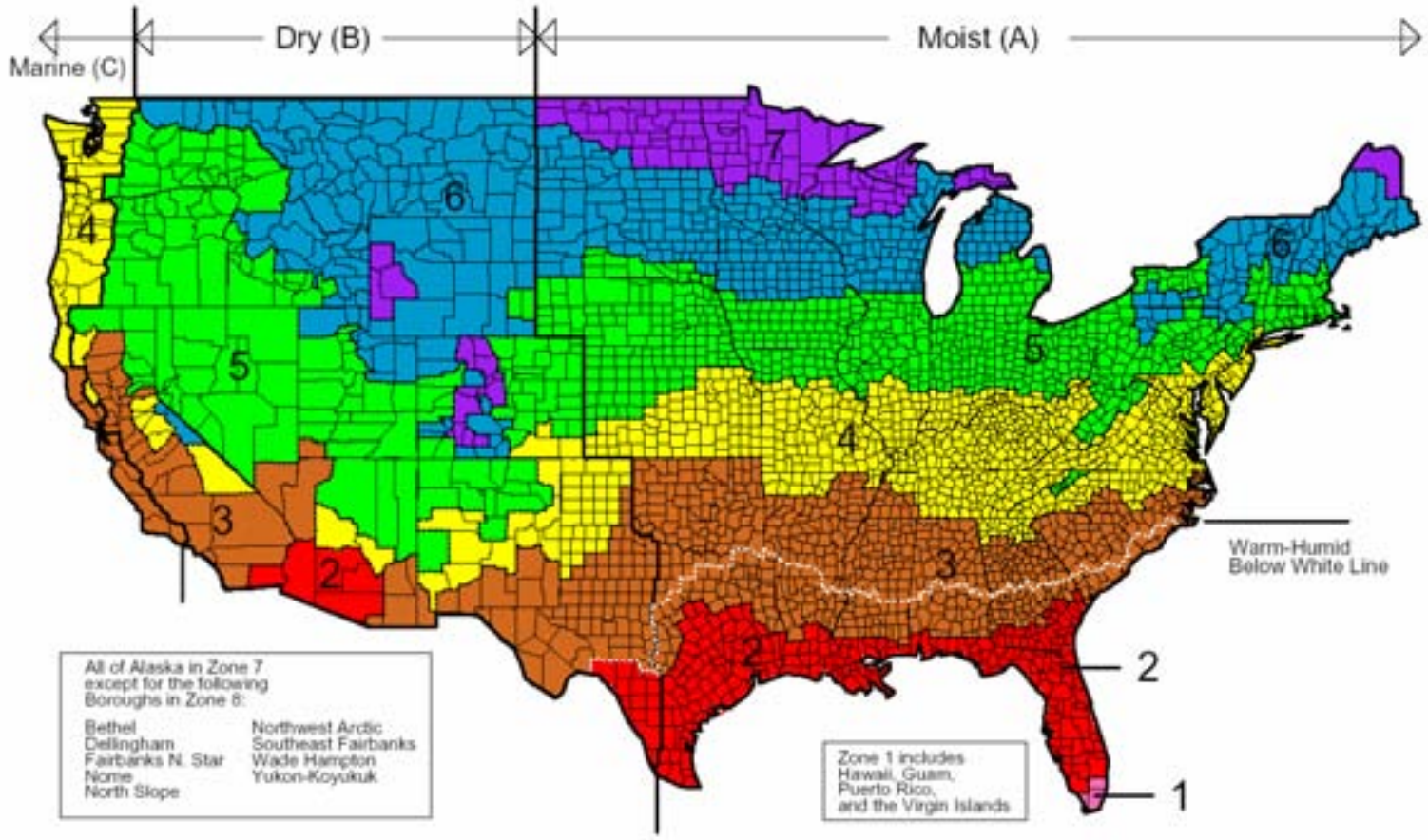
Guiding principles

- **Provide a way, <u>but not the only way</u> of achieving 30% energy savings**
- **Use energy savings as the independent variable vs. cost effectiveness**
- **Use practical, off-the-shelf technology**
- **Produce a useful document in a timely manner**
  - *October 2003 to February 2005*

The Guide has specific recommendations for…

- **Building Envelope**
  - *Roofs*
  - *Walls*
  - *Floors*
  - *Slabs*
  - *Doors*
  - *Vertical Glazing*
  - *Skylights*
- **Lighting**
  - *Daylighting*
  - *Interior Electric Lighting*
  - *Controls*
- **HVAC Equipment and Systems**
  - *Cooling Equipment Efficiencies*
  - *Heating Equipment Efficiencies*
  - *Supply Fans*
  - *Ventilation Control*
  - *Ducts*
- **Service Water Heating**
  - *Equipment efficiencies*
  - *Pipe insulation*
- **In addition, "Bonus Savings" strategies to improve energy efficiency beyond the 30% are included for:**
  - *Exterior Façade Lighting*
  - *Parking Lot Lighting*
  - *Plug Loads*

Climate Zones



Where is the Energy Used?

Annual Energy Use in MBTU - 5000 SF Office Building (Round 4)

	Location	*Climate Zone*	*Lighting*	*Cooling*	*Heating*	*Fans*	*SWH*	*Plugs*	*Aux*	*Total*	*Savings w/ Plug*	*Savings wo Plug*
Base	Duluth MN	Zone 7	77.7	11.1	224.5	40.7	14.6	38.9	1.0	408.5	-	-
Advanced	Duluth MN	Zone 7	49.3	5.3	102.9	28.1	6.3	38.9	1.0	231.8	43.3%	47.8%
	Savings over Base		*28.4*	*5.8*	*121.6*	*12.6*	*8.3*	*0.0*	*0.0*	*176.7*		
	Savings % over Base		*36.6%*	*52.3%*	*54.2%*	*31.0%*	*56.8%*	*0.0%*	*0.0%*	*43.3%*		
	% savings		*16.1%*	*3.3%*	*68.8%*	*7.1%*	*4.7%*	*0.0%*	*0.0%*			
Base	Miami FL	Zone 1	77.7	75.5	0.0	32.3	10.3	38.9	0.0	234.7	-	-
Advanced	Miami FL	Zone 1	49.3	47.7	0.0	25.2	3.4	38.9	0.0	164.5	29.9%	35.9%
	Savings over Base		*28.4*	*27.8*	*0.0*	*7.1*	*6.9*	*0.0*	*0.0*	*70.2*		
	Savings % over Base		*36.6%*	*36.8%*	*0.0%*	*22.0%*	*67.0%*	*0.0%*	*0.0%*	*29.9%*		
	% savings		*40.5%*	*39.6%*	*0.0%*	*10.1%*	*9.8%*	*0.0%*	*0.0%*			
Base	Phoenix AZ	Zone 2	77.7	74.7	1.1	41.5	10.8	38.9	0.2	244.9	-	-
Advanced	Phoenix AZ	Zone 2	49.3	44.4	1.0	33.0	3.6	38.9	0.2	170.4	30.4%	36.2%
	Savings over Base		*28.4*	*30.3*	*0.1*	*8.5*	*7.2*	*0.0*	*0.0*	*74.5*		
	Savings % over Base		*36.6%*	*40.6%*	*9.1%*	*20.5%*	*66.7%*	*0.0%*	*0.0%*	*30.4%*		
	% savings		*38.1%*	*40.7%*	*0.1%*	*11.4%*	*9.7%*	*0.0%*	*0.0%*			
Base	Seattle WA	Zone 4	77.7	12.5	39.5	24.3	13.3	38.9	0.7	206.9	-	-
Advanced	Seattle WA	Zone 4	49.3	5.8	33.4	20.7	5.2	38.9	0.7	154.0	25.6%	31.5%
	Savings over Base		*28.4*	*6.7*	*6.1*	*3.6*	*8.1*	*0.0*	*0.0*	*52.9*		
	Savings % over Base		*36.6%*	*53.6%*	*15.4%*	*14.8%*	*60.9%*	*0.0%*	*0.0%*	*25.6%*		
	% savings		*53.7%*	*12.7%*	*11.5%*	*6.8%*	*15.3%*	*0.0%*	*0.0%*			

What are the savings

Location	*Climate Zone*	*EUI*	*Savings w/ Plug*	*Savings wo Plug*
Miami FL	Zone 1	32.5	30.8%	36.7%
Houston TX	Zone 2	30.0	33.9%	40.6%
Phoenix AZ	Zone 2	32.7	34.8%	41.0%
El Paso	Zone 3	28.3	29.3%	36.2%
Memphis TN	Zone 3	31.0	28.0%	34.0%
San Francisco CA	Zone 3	23.5	31.9%	40.8%
Albuquerque NM	Zone 4	29.4	30.3%	37.0%
Baltimore MD	Zone 4	33.4	31.5%	37.3%
Seattle WA	Zone 4	29.4	27.2%	33.5%
Boise ID	Zone 5	34.3	30.5%	36.0%
Chicago IL	Zone 5	39.1	31.7%	36.6%
Burlington VT	Zone 6	42.0	32.8%	37.3%
Helena MT	Zone 6	39.6	32.3%	37.1%
Duluth MN	Zone 7	43.9	40.1%	44.8%
Fairbanks AK	Zone 8	58.4	39.4%	42.8%

Baseline assumptions

Characteristic	Baseline Model	Data Source/Remarks
Lighting		
Light Source	T-8 with electronic ballast	General practice
Peak Lighting Power, w/sf	1.3 w/sf of gross floor area	ASHRAE 90.1-1999 Table 9.3.1.1
Lighting Schedule	8 am – 5 pm, M-F	
Occupancy Sensors	No	
Daylighting Responsive Lighting Control	No	

Advanced assumptions

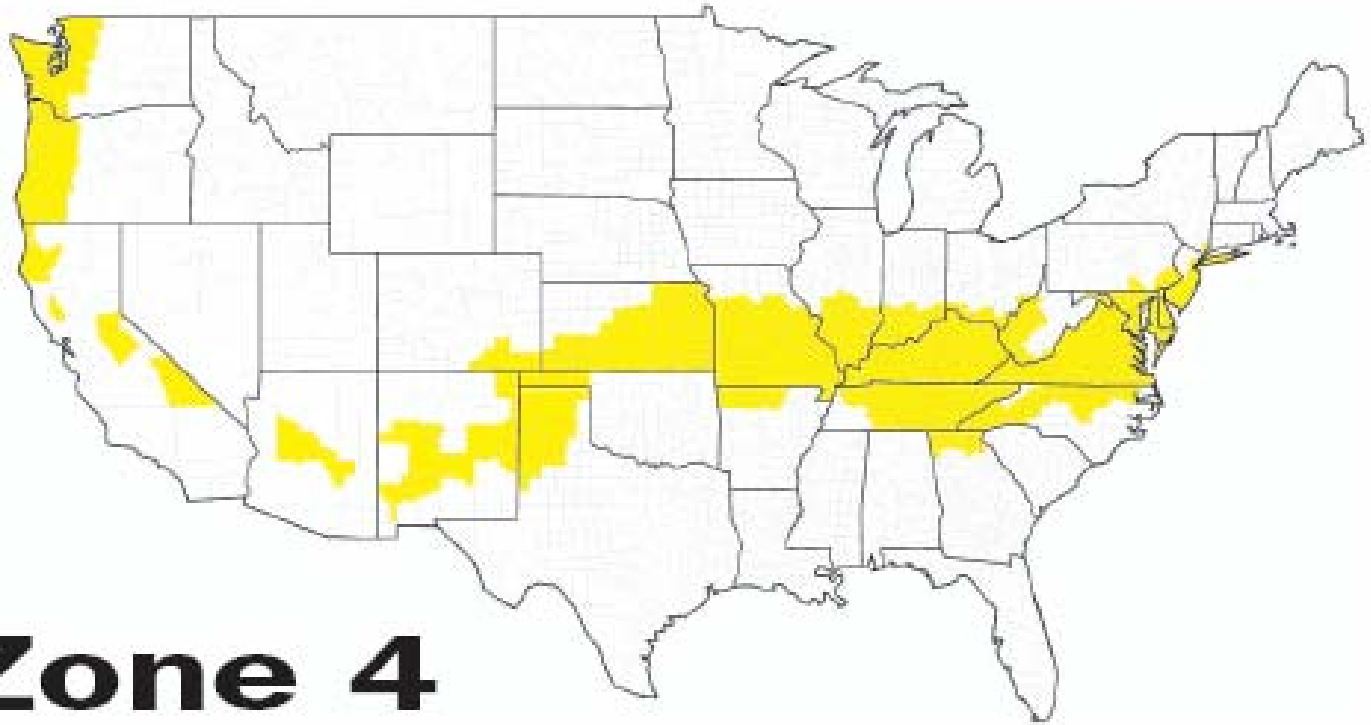
Characteristic	Advanced Model	Data Source/Remarks
Lighting		
Light Source	High-Performance T-8s	SP102 Recommendation
Peak Lighting Power, w/sf	0.9 w/sf of gross floor area	SP 102 Committee Inputs
Lighting Schedule	8 am – 5 pm, M-F Modified OFF_M-F_LIGHT	Based on SP102 committee input, lighting schedule is modified to match the average energy savings of 20% for private office and 10% for open office using occupancy for open office using occupancy sensors.
Occupancy Sensors	Yes	
Daylighting Responsive Lighting Control	Daylighting dimming control for south and north perimeter zones only	SP102 Recommendation

Baseline LPD

Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.73	0.073
Other Areas	10%	0.97	0.097
Lobby	10%	1.75	0.175
Office - enclosed	25%	1.54	0.385
Office - open plan	20%	1.28	0.256
Conference Meeting/Multipurpose	10%	1.5	0.15
Active storage	15%	1.13	0.1695
	100.0%		1.3055

Advanced LPD

Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other Areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899



Zone 4

Arizona
- Gila
- Yavapai

Arkansas
- Baxter
- Benton
- Boone
- Carroll
- Fulton
- Izard
- Madison
- Marion
- Newton
- Searcy
- Stone

Illinois
- Alexander
- Bond
- Brown
- Christian
- Clay
- Clinton
- Crawford
- Edwards
- Effingham
- Fayette
- Franklin
- Gallatin
- Hamilton
- Hardin
- Jackson
- Posey
- Ripley
- Scott
- Spencer
- Sullivan
- Switzerland
- Vanderburgh
- Warrick
- Washington

Kansas

All counties except:
- Cheyenne
- Cloud
- Decatur
- Grundy
- Harrison
- Holt
- Knox
- Lewis
- Linn
- Livingston
- Macon
- Marion
- Mercer
- Nodaway
- Pike
- Putnam
- Rails
- Schuyler
- Scotland
- Caldwell
- Caswell
- Catawba
- Chatham
- Cherokee
- Clay
- Cleveland
- Davie
- Durham
- Forsyth
- Franklin
- Gates
- Graham
- Granville
- Guilford
- Halifax
- Clatsop
- Columbia
- Coos
- Curry
- Douglas
- Jackson
- Josephine
- Lane
- Lincoln
- Linn
- Marion
- Multnomah
- Polk
- Tillamook
- Washington
- Yamhill
- Ochiltree
- Oldham
- Parmer
- Potter
- Randall
- Roberts
- Sherman
- Swisher
- Yoakum

Virginia
- All counties

Washington
- Clallam
- Clark

Photographs courtesy of Tom Bender

Figure 3-12. Energy-efficient office equipment and flat-screen computer monitors minimize energy and heat loads, in addition to adding critical workspace at each installation, in the Bank of Astoria.

Zone 4—Bank of Astoria

MANZANITA, ORE.

The Bank of Astoria is not a typical financial institution. Nestled on a wooded landscape in Manzanita, the bank does more than just handle financial matters. Designed by architect Tom Bender, it is a building that exhibits a wealth of sustainable elements.

Site location and building orientation were taken advantage of to allow south-facing windows and skylights for solar gain. Windows and skylights provide inviting views into the building and from the building into its entry garden. In addition, the windows and skylights provide 100 percent daylighting to all areas of the bank, except the vault. The windows are all occupant-controlled and provide 100 percent of ventilation needs. No air conditioning is used with the building; instead, a night-flushing ventilation system is used to pre-cool the building with the region's cool nighttime air. The system incorporates a high-level exhaust vent that uses gravity to vent hot air from the building, maintaining interior air temperatures at comfortable levels.

Siltation blockage of permeable paving was a concern, which led to two separate demonstration techniques. The first is a prefab plastic infiltration vault system under the drive-through paving. In the second system, water from the roof is discharged through a

This example building demonstrates good design and construction practices suitable for this particular climate zone. In some cases, the example building may have incorporated additional features that go beyond the scope of the recommendations of this Guide.

Climate Zone 4 Recommendation Table

	Item	Component	Recommendation	How-To's in Chapter 4
Envelope	Roof	Insulation entirely above deck	R-20 c.i.	EN2, 17, 20-21
		Metal building	R-13 + R-19	EN3, 17, 20-21
		Attic and other	R-38	EN4, 17-18, 20-21
		Single rafter	R-38	EN5, 17, 20-21
		Surface reflectance/emittance	No recommendation	
	Walls	Mass (HC = 7 Btu/ft^2)	R-11.4 c.i.	EN6, 17, 20-21
		Metal building	R-13	EN7, 17, 20-21
		Steel framed	R-13 + R-7.5 c.i.	EN8, 17, 20-21
		Wood framed and other	R-13	EN9, 17, 20-21
		Below-grade walls	No recommendation	EN10, 17, 20-21
	Floors	Mass	R-8.3 c.i.	EN11, 17, 20-21
		Steel framed	R-30	EN12, 17, 20-21
		Wood framed and other	R-30	EN13, 17, 20-21
	Slabs	Unheated	No recommendation	EN17, 19-21
		Heated	R-7.5 for 24 in.	EN14, 17, 19-21
	Doors	Swinging	U-0.70	EN15, 20-21
		Non-swinging	U-0.50	EN16, 20-21
	Vertical Glazing	Window to wall ratio (WWR)	20% to 40% maximum	EN23, 36-37
		Thermal transmittance	U-0.42	EN24
		Solar heat gain coefficient (SHGC)	N, S, E, W = 0.46 N only = 0.46	EN27-28
		Window orientation	$(A_N * SHGC_N + A_S * SHGC_S) + (A_E * SHGC_E + A_W * SHGC_W)$	A_x=window area for orientation x EN26-32
		Exterior sun control (S, E, W only)	Projection factor 0.6	EN24, 28, 30, 36, 40, 42 DL5-6
	Skylights	Maximum percent of roof area	3%	DL5-7, DL8, DL13
		Thermal transmittance	U-0.69	DL7, DL8, DL13
		Solar heat gain coefficient (SHGC)	0.34	DL8, DL13
Lighting	Interior Lighting	Lighting power density (LPD)	0.9 W/ft^2	EL1-2, 4, 8, 15-16
		Light source (linear fluorescent)	90 mean lumens/watt	EL4, 9, 17
		Ballast	Electronic ballast	EL4
		Dimming controls for daylight harvesting for WWR 25% or higher	Dim fixtures within 12 ft of N/S window wall or within 8 ft of skylight edge	DL1, 9-11, EL6-7
		Occupancy controls	Auto-off all unoccupied rooms	DL2, EL5, 6
		Interior room surface reflectances	80%+ on ceilings, 70%+ on walls and vertical partitions	DL3-4, EL3
HVAC	HVAC	Air conditioner (0-65 KBtu/h)	13.0 SEER	HV1- 2, 4, 6, 12, 16-17, 20
		Air conditioner (>65-135 KBtu/h)	11.0 EER/11.4 IPLV	HV1- 2, 4, 6, 12, 16-17, 20
		Air conditioner (>135-240 KBtu/h)	10.0 EER/11.2 IPLV	HV1- 2, 4, 6, 12, 16-17, 20
		Air conditioner (>240 KBtu/h)	10.0 EER/10.4 IPLV	HV1- 2, 4, 6, 12, 16-17, 20
		Gas furnace (0-225 KBtu/h - SP)	80% AFUE or E_t	HV1- 2, 5, 16, 20
		Gas furnace (0-225 KBtu/h - Split)	80% AFUE or E_t	HV1- 2, 6, 16, 20
		Gas furnace (>225 KBtu/h)	80% E_t	HV1- 2, 6, 16, 20
		Heat pump (0-65 KBtu/h)	13.0 SEER/7.7 HSPF	HV1- 2, 4, 6, 12, 16-17, 20
		Heat pump (>65-135 KBtu/h)	10.6 EER/11.0 IPLV/3.2 COP	HV1- 2, 4, 6, 12, 16-17, 20
		Heat pump (>135 KBtu/h)	10.1 EER/11.0 IPLV/3.1 COP	HV1- 2, 4, 6, 12, 16-17, 20
	Economizer	Air conditioners & heat pumps - SP	Cooling capacity > 54 KBtu/h	HV23
	Ventilation	Outdoor air damper	Motorized control	HV7-8
		Demand control	CO_2 sensors	HV7, 22
	Ducts	Friction rate	0.08 in. w.c./100 feet	HV9, 18
		Sealing	Seal class B	HV11
		Location	Interior only	HV9
		Insulation level	R-6	HV10
Water	Service Water Heating	Gas storage	90% E_t	WH1-4
		Gas instantaneous	0.81 EF or 81% E_t	WH1-4
		Electric storage 12 kW	EF = 0.96 – 0.0012x Volume	WH1-4
		Pipe insulation (d=1½ in./ d1½ in.)	1 in./ 1½ in.	WH6

Note: If the table contains "No recommendation" for a component, the user must meet the more stringent of either Standard 90.1 or the local code requirements in order to reach the 30% savings target.

	Vertical Glazing	Window to wall ratio (WWR)	20% to 40% maximum	EN23, 36-37
		Thermal transmittance	U-0.42	EN25
		Solar heat gain coefficient (SHGC)	N, S, E, W - 0.46 N only - 0.46	EN27-28
		Window orientation	$(A_N * SHGC_N + A_S * SHGC_S) > (A_E * SHGC_E + A_W * SHGC_W)$	A_x–Window area for orientation x EN26-32
		Exterior sun control (S, E, W only)	Projection factor 0.5	EN24, 28, 30, 36, 40, 42 DL5-6
	Skylights	Maximum percent of roof area	3%	DL5-7, DL8, DL13
		Thermal transmittance	U-0.69	DL7, DL8, DL13
		Solar heat gain coefficient (SHGC)	0.34	DL8, DL13
Lighting	Interior Lighting	Lighting power density (LPD)	0.9 W/ft^2	EL1-2, 4, 8, 10-16
		Light source (linear fluorescent)	90 mean lumens/watt	EL4, 9, 17
		Ballast	Electronic ballast	EL4
		Dimming controls for daylight Harvesting for WWR 25% or higher	Dim fixtures within 12 ft of N/S window wall or within 8 ft of skylight edge	DL1, 9-11, EL6-7
		Occupancy controls	Auto-off all unoccupied rooms	DL2, EL5, 6
		Interior room surface reflectances	80%+ on ceilings, 70%+ on walls and vertical partitions	DL3-4, EL3

Recommendations for Daylighting Controls

- **Dimming controls.**
  - *In office work areas, continuously dim rather than switch electric lights.*
  - *Automatic multi-level daylight switching may be used in non-office environments such as hallways, storage, restrooms, lounges, lobbies, etc.*
  - *Locate luminaires in rows parallel to the window wall and wire each row separately.*
  - *The daylighting control system and/or photosensor should include a five-minute time delay or other means to avoid cycling.*

PGE Earth Advantage Center; Tualatin, OR

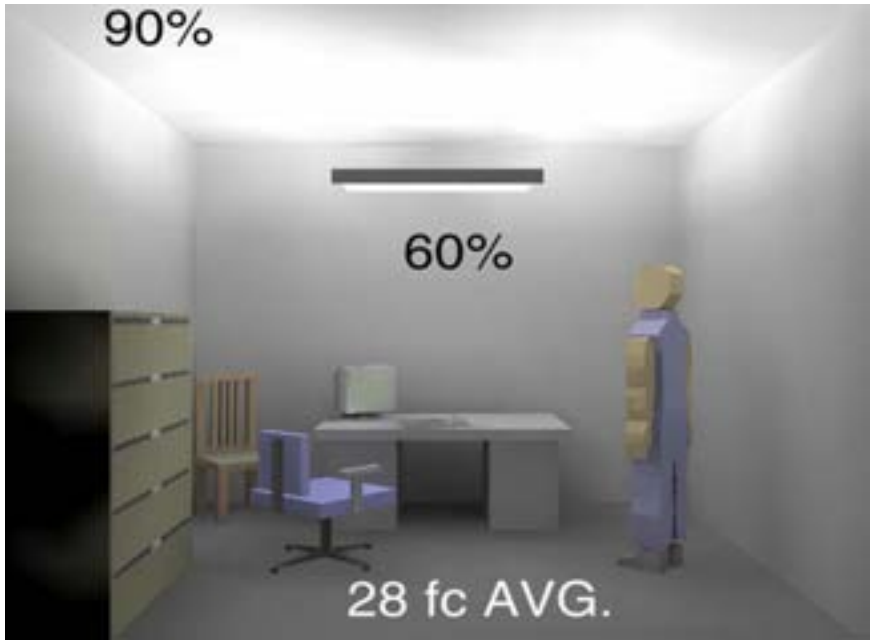
Task Lighting

- **Use “articulated” task lights (i.e., adjustable in three planes by the worker) with compact fluorescent sources for desktops.**
- **Provide local switches on task lighting, or connect them to specialized plugstrips controlled by local occupancy sensors.**
- **Hardwire the lower output level of a two-stepped T8 electronic ballast for under-cabinet lighting.**

Courtesy: Watt Stopper, Luxo

Reflectance

- **A 90% ceiling reflectance is preferred for indirect luminaires and daylighting.**
- **Avoid shiny surfaces (mirrors, polished metals, or stone) in work areas.**



Lamps and Ballasts

- **To achieve the maximum 0.9 W/ft^2 connected load recommended in chapter 3, "high performance" T8 lamps and program start ballasts were assumed.**

- **Premium / Super / Enhanced / High-Lumen T8 lamps:**
  - **Produce 3,100 initial lumens or more**
  - **Maintain 2,915 or greater mean lumens**
  - **Provide 85 or greater Color Rendering Index**
  - **Achieve a rated life of 24,000 hours or greater (under standard testing procedures).**

Occupancy Sensors

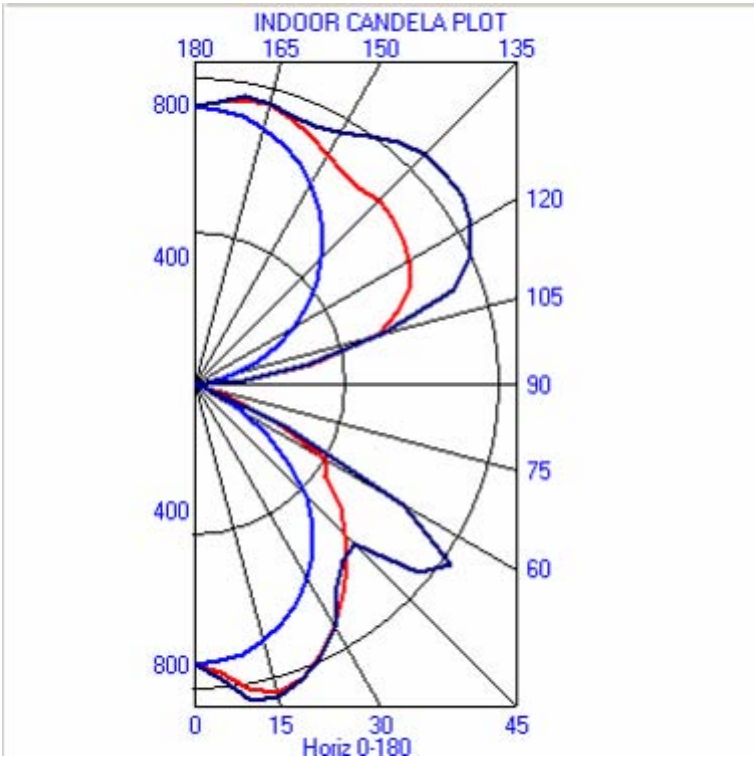
- **In private offices, infrared wall box sensors should be pre-set for manual On automatic Off operation.**
- **Automatic time scheduling is an alternative to occupancy sensors in open plan offices.**
- **In nondaylighted areas, ceiling-mounted occupancy sensors are preferred.**
- **Occupancy sensors should be set for medium to high sensitivity and a 15-minute time delay.**

Courtesy: Leviton

Fluorescent T5 Sources

- **T5HO and T5 lamps may be part of a solution.**
- **They have initial lumens per watt that compare favorably to the high-performance T8.**
- **T5s use fewer natural resources (glass, metal, phosphors) than a comparable lumen output T8 system.**
- **T5s have higher surface brightness and should not be used in open-bottom fixtures.**

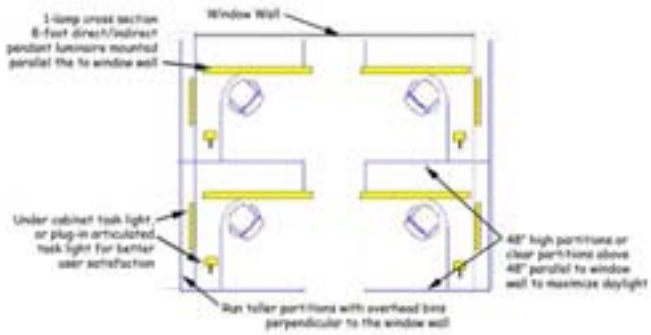
Light Fixture Distribution



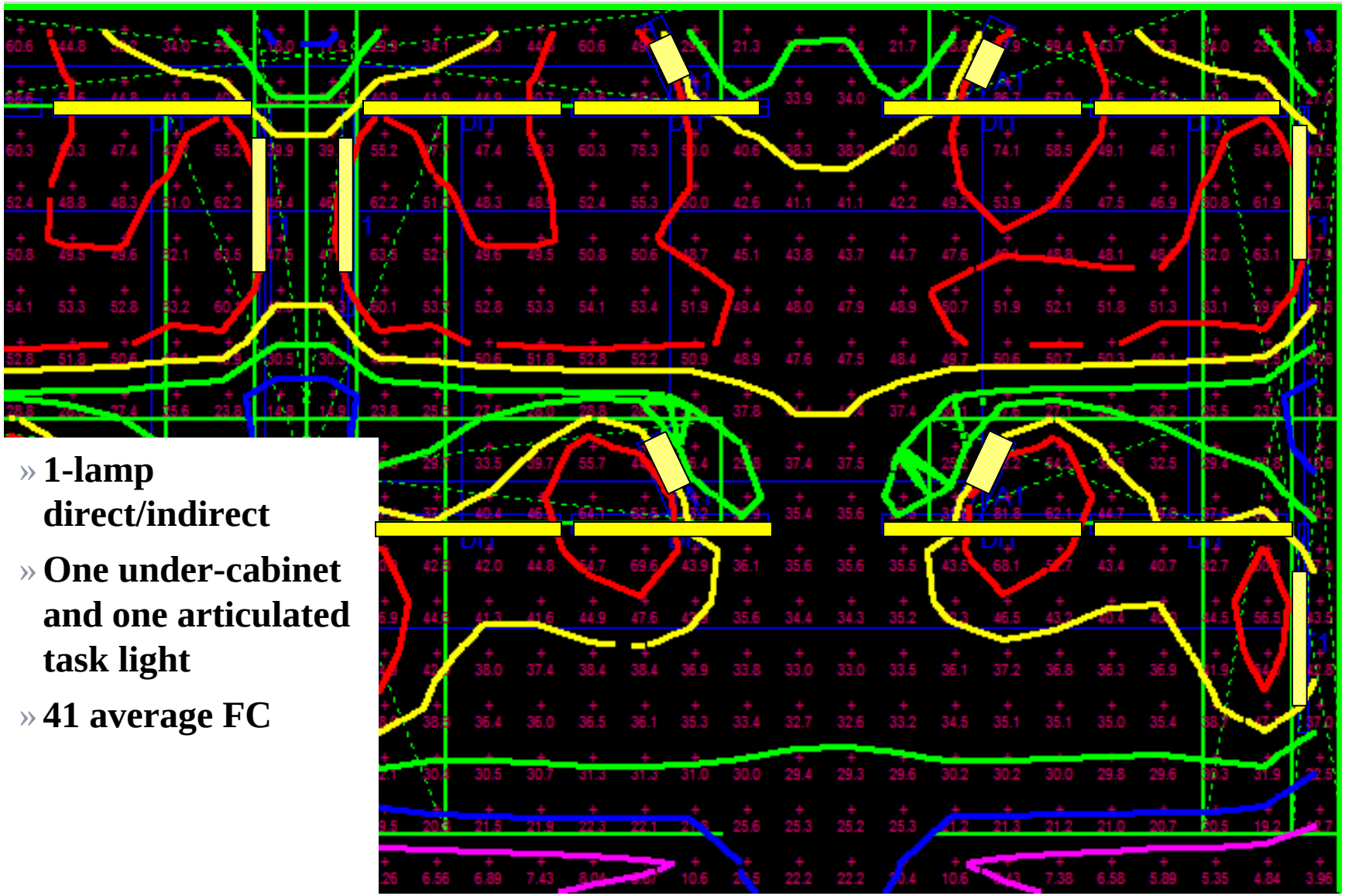
- **Direct/indirect luminaries are use as the primary source.**
- **Recessed direct fixtures may meet the watts per square foot allowance and the illuminance recommendations for offices.**
- **Extensive use of totally indirect luminaires or recessed direct-indirect (coffer-type) fixtures may not achieve the desired light levels while meeting the 0.9 W/ft^2 goal.**

Open Plan Office

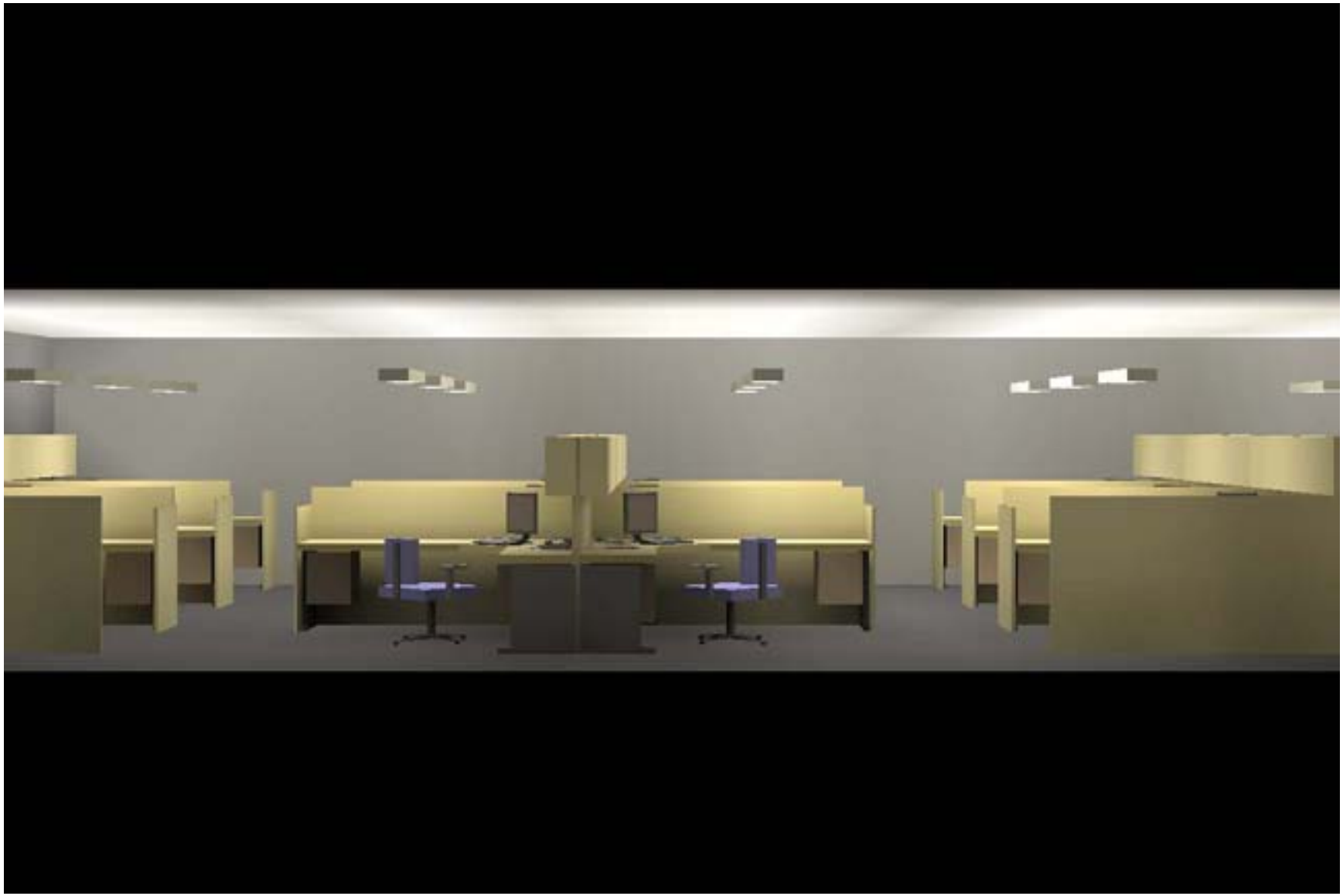
Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other Areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899



- **The target lighting in open offices is 30 average maintained footcandles for ambient lighting with a total of at least 50 footcandles provided on the desktop.**
- **Use daylight dimming ballasts and photocell control in daylight zone (within 12 feet of window wall) if WWR is greater than 25% in this area.**
- **Use occupancy sensor local control or scheduling on all luminaires.**

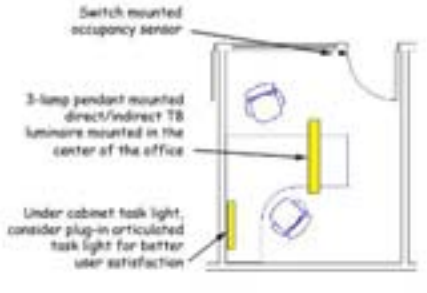


- **1-lamp direct/indirect**
- **One under-cabinet and one articulated task light**
- **41 average FC**



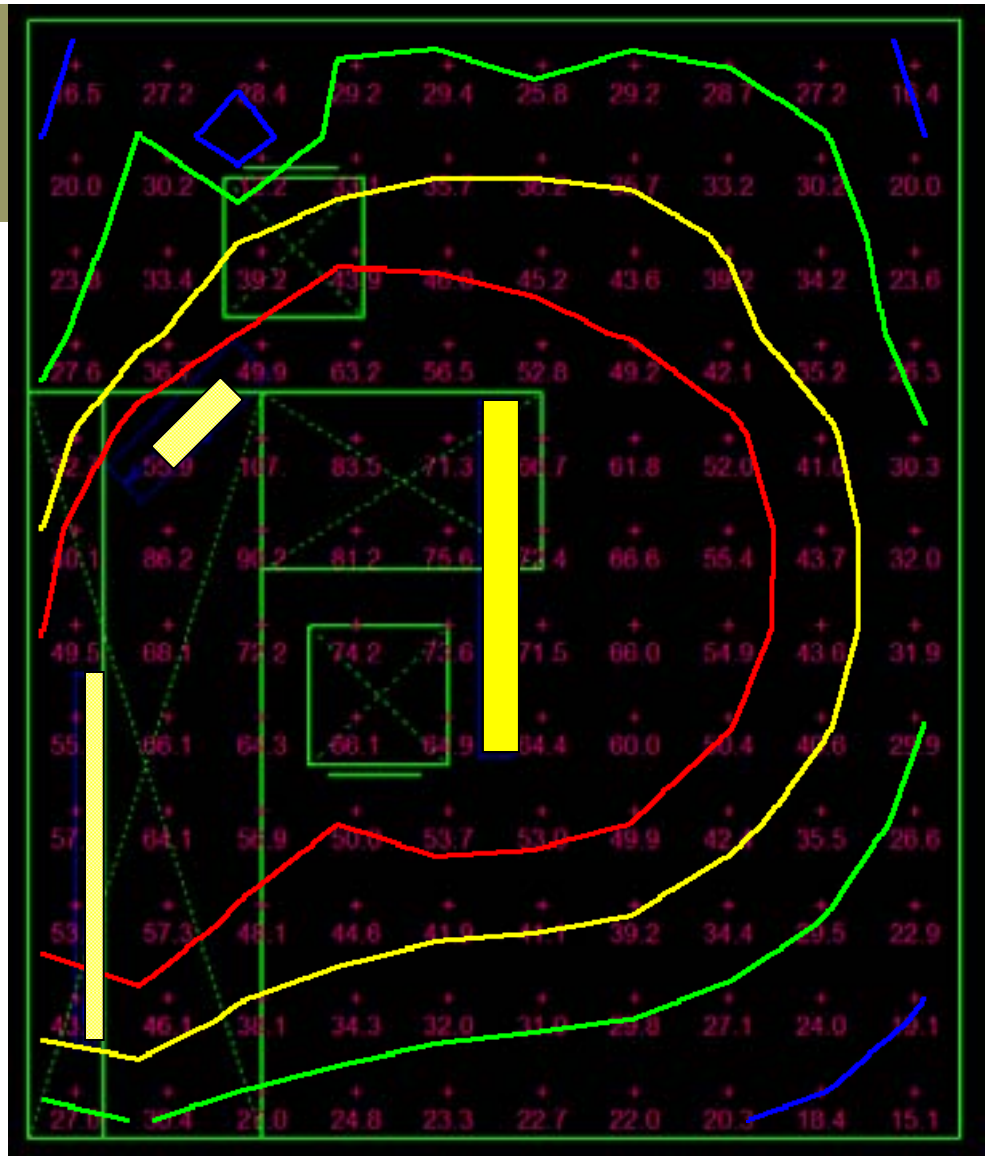
Private Office

Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other Areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899

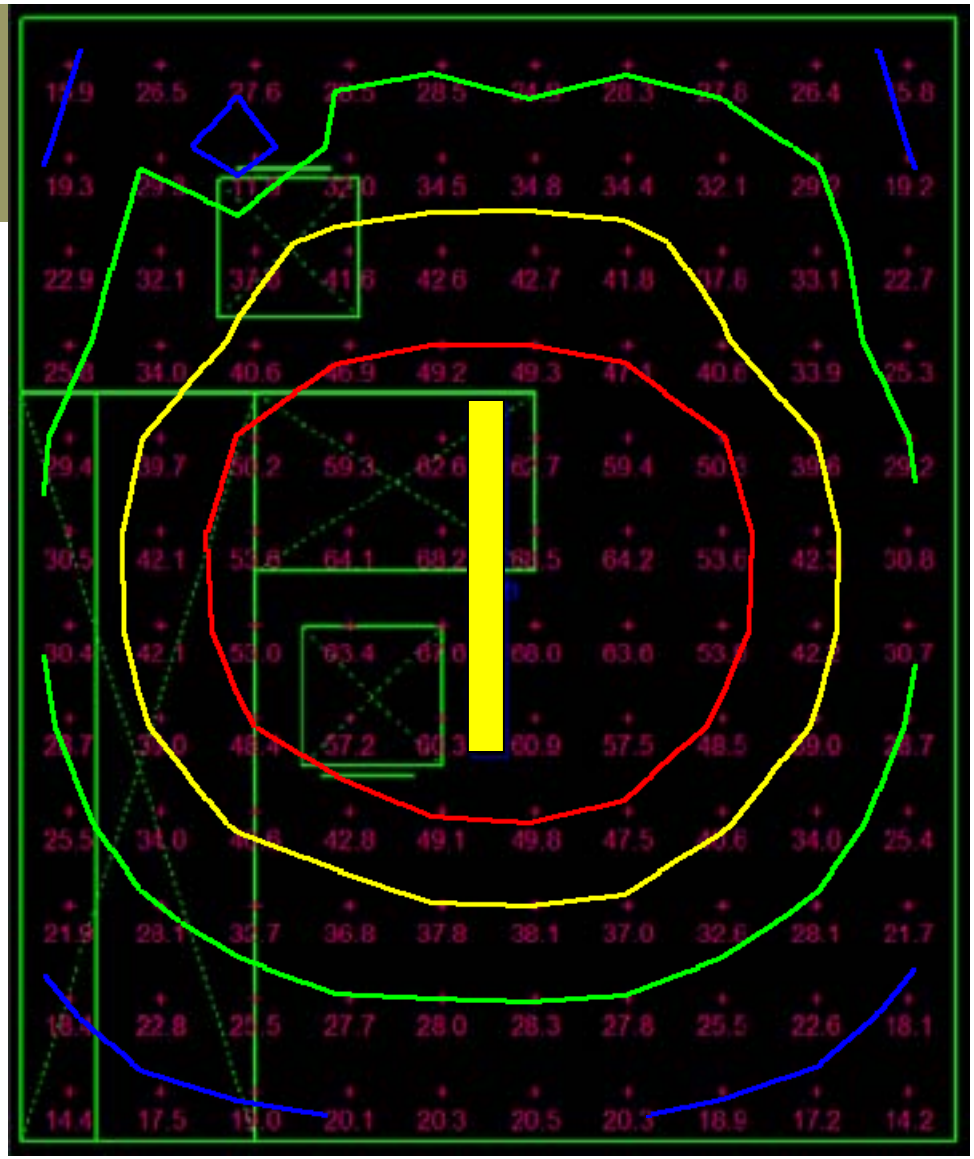


- **The target lighting in private offices is 30 average maintained footcandles for ambient lighting with a total of at least 50 footcandles provided on the desktop.**
- **Use occupancy sensor local control.**

- **“Guide layout”**
- **3-lamp direct/indirect**
- **Under Cabinet and articulated task light**
- **42 average FC**

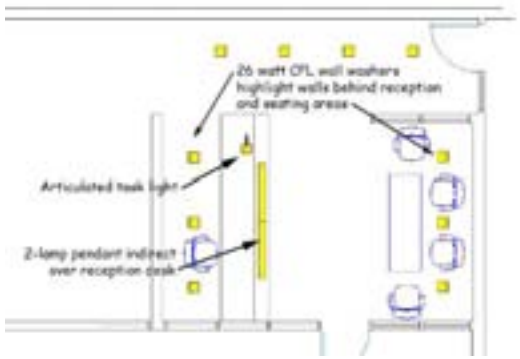


- **Same layout without task light.**
- **36 average FC**



Lobbies

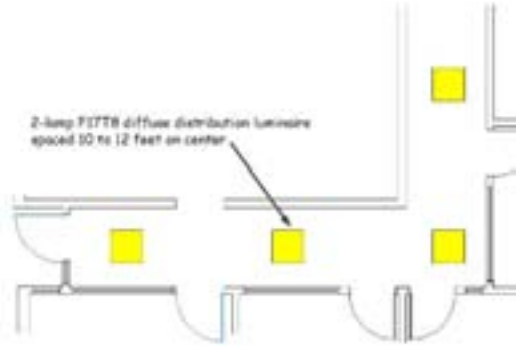
Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other Areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899



- **The target lighting in the lobby is 10-15 average maintained footcandles.**
- **Highlight wall surfaces and building directory.**

Corridors

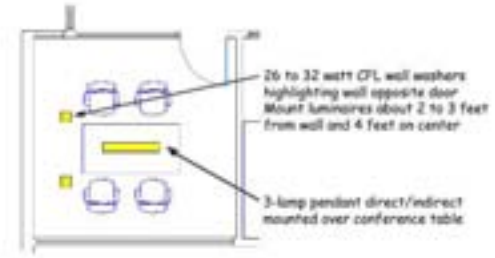
Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other Areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899



- **The target lighting in the corridors is 5-10 average maintained footcandles.**
- **Choose luminaires that light the walls and provide relatively uniform illumination.**
- **Optional layouts using one-lamp 1 × 4 or 26-watt CFL sconce or ceiling luminaires may be used to minimize the number of lamp types on the project.**

Conference/Meeting Rooms

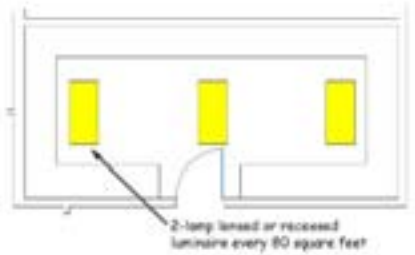
Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other Areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899



- **The target lighting in the conference room is 30-40 average maintained footcandles.**
- **Use occupancy sensor local control.**

Storage

Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899



- **The target lighting in the storage is 5-15 average maintained footcandles.**

Other Areas

Space Type	Floor space allocation	LPD	LPD*area
Corridor/Transition	10%	0.55	0.055
Other areas	10%	0.75	0.075
Lobby	10%	1.09	0.109
Office - enclosed	25%	0.94	0.235
Office - open plan	20%	1.03	0.206
Conference Meeting/Multipurpose	10%	1.02	0.102
Active storage	15%	0.78	0.117
	100.0%		0.899

- **Lighting in remaining 10% of the office space is composed of various functions including restrooms, electrical/mechanical rooms, stairways, workshops, and others.**
- **Average the connected load in these spaces to 0.75 W/ft2, which is equivalent to about one two lamp high-performance T8 luminaire every 80 ft2.**
- **Use occupancy sensors or timers where appropriate.**

Exterior Lighting

- **Limit exterior lighting power to 0.10 W/ft^2 for parking lot and grounds lighting.**
- **Avoid the use of decorative façade lighting.**
- **Parking lot lighting should not be significantly brighter than lighting of the adjacent street. Follow IESNA RP-33-1999 recommendations for uniformity and illuminance recommendations.**
- **Use photocell or astronomical time switch on all exterior lighting.**

LEED-NC Version 2.2

EA Credit 1: Optimize Energy Performance

- **OPTION 2 - PRESCRIPTIVE COMPLIANCE PATH (4 Points)**
  - *Comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide for Small Office Buildings 2004. The following restrictions apply:*
    - Buildings must be under 20,000 square feet
    - Buildings must be office occupancy
    - Project teams must fully comply with all applicable criteria as established in the Advanced Energy Design Guide for the climate zone in which the building is located

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Advanced Energy Design Guide For Small Office Buildings

New Design Guide Delivers Maximum Energy Savings
For developing energy-efficient buildings, the Advanced Energy Design Guide provides a sensible approach by including practical products and readily-available, "off-the-shelf" technology. The Guide offers you all the tools you need to create an energy-efficient building where the owners will see a 30 percent energy savings compared to buildings that only meet the minimum requirements of Standard 90.1.

This four-color guide presents a simple approach to energy design for contractors and designers of office buildings up to 20,000 sq. ft. Ideal for the Contracting, Design and Remodeling industries, this peer-reviewed Guide features a user-friendly format and contains "how-to" guidance. The Guide provides benefits and savings for building owners while maintaining quality and functionality of the office space.

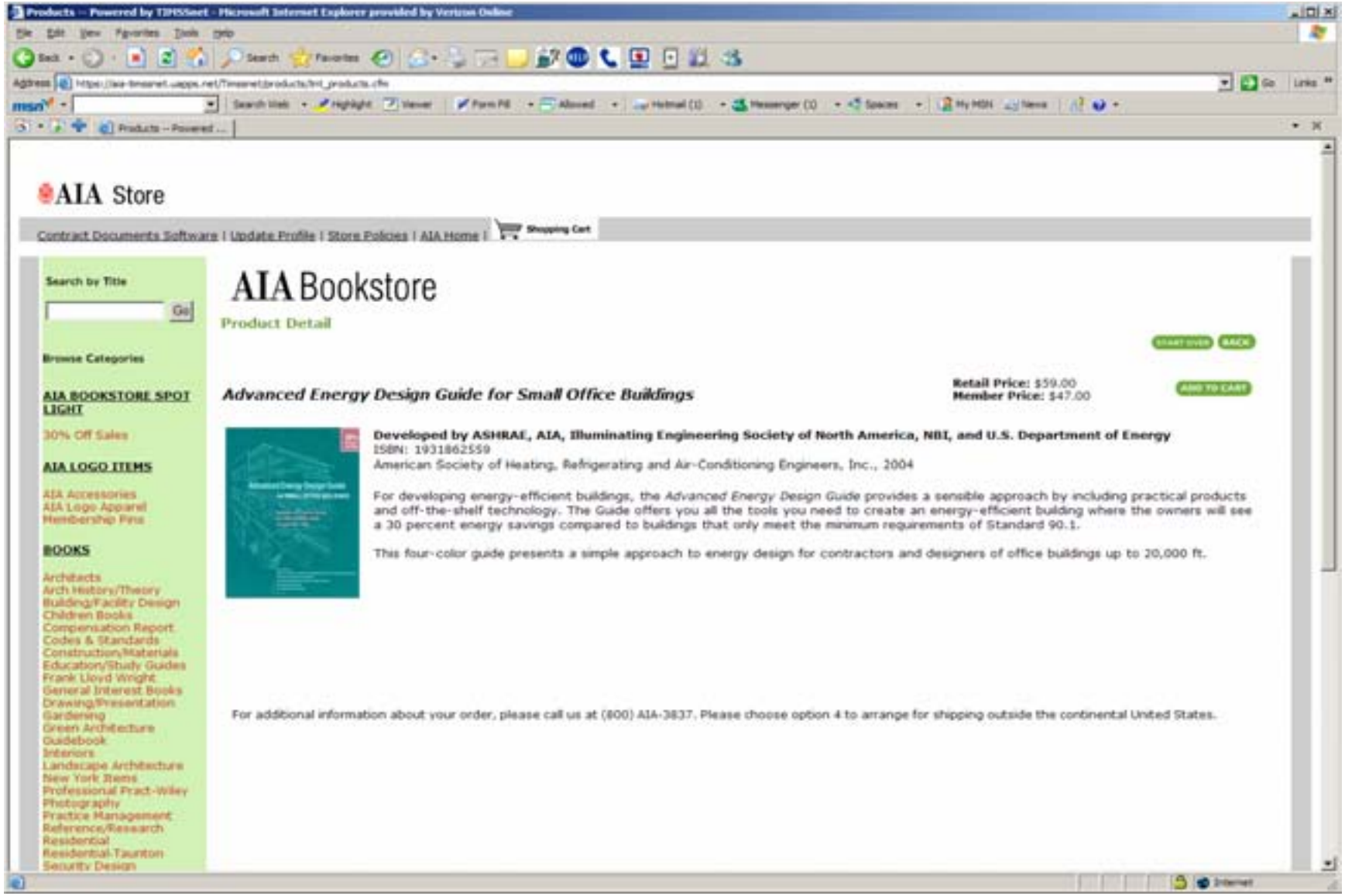
The Guide includes:

- Easy to follow climate zones for your geographic region
- Recommendations for achieving energy efficiency credits for LEED
- Bonus strategies for saving energy outside the building
- Ways to retrofit existing buildings and renovations

This Guide helps meet all of the owner's energy performance requirements, since it was developed by a diverse group of energy professionals: ASHRAE, the American Institute of Architects (AIA), New Buildings Institute (NBI), and the Illuminating Engineering Society of North America (IESNA). Soft cover; 8.5" X 11"; I-P; 2004; ASHRAE.

This document contains recommendations and is not a minimum code or standard. It is intended to be used in addition to the existing codes and standards and is not intended to circumvent them.

- Read the March 2005 **ASHRAE Journal article** on the Advanced Energy Design Guide.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